surface and a pulse duration less than 150 nanoseconds;

23. A method of claim 21, in which the said ablative laser is a mid-IR solid-state laser having a wavelength of about (2.7-3.2) microns. and a pulse duration less than 150 nanoseconds.
24. The method of claim 21, in which the said ablative laser includes pulsed radiation generated by transverse electrical discharge carbon dioxide laser which is frequency-doubled into a laser having a wavelength of about (5.6-6.2) microns, energy per pulse of about (2-15) mJ on the corneal surface.
25. A method of claim 21, in which the said ablative laser is a diode laser having a wavelength of about 980 nm.
26. A method of claim 21, in which the said ablative laser is a diode laser having a wavelength of about (1.4 - 2.1) microns.
27. A method of claim 21, in which the said ablative laser is a diode-pumped Er:YAG laser having a wavelength about 2.9 microns and a pulse duration less than 500 microseconds.
28. A method of claim 21, in which the said ablative laser is an ultraviolet laser having a wavelength of about (190-310) nm.
29. A method of claim 21, in which the said sclera tissue is coagulated by a laser having a wavelength of about (0.5-3.2) microns, an average power of about (0.1-5.0) W on the corneal surface, spot size of about (0.1-1.0) mm, and a pulse duration longer than about 200 microseconds.
30. A method of claim 21, in which the said ablative laser is fiber-coupled and combined with a coagulation laser and delivered to the corneal surface.
31. A method of claim 21, in which the said sclera ciliary tissue is ablated in radial patterns having a length about (2.5-3.5) mm and a depth about (400-700) microns.
32. A method of claim 21, in which the said sclera ciliary tissue is ablated in radial patterns by a computer-controlled scanning mechanism.
33. A method of claim 21, in which the said sclera ciliary tissue is ablated in radial patterns by a translation mechanism.

(II) REMARKS:

Detailed discussion and comparison of prior arts and the present patent in responding to the comments from the Examiner.

(1) For Claims 1-6, the prior art of Lin in Pat. no. 5,520,679 did not teach the new gas laser generated by a transverse electrical discharge in a mixture of neutral gases including at least helium gas or teach the design of spot controller consisting of an internal magnetic coupler integrated inside the laser cavity having a pin-hole. Therefore the independent Claim 1 using the new gas laser for the corneal reshaping by a scanning method is innovative.

(2) Relating to Claims 7-19 of the present patent, there are several fundamental differences between the prior arts and the present patent:

(a) The laser-tissue interaction area cited in prior arts patented by Lin, Knopp, Tang, Telfair, Machat, Sand and Rajan are all within the central portion of the cornea, whereas the laser ablation proposed by the present patent is outside the corneal limbus area.

(b) In the prior arts, the laser is used to change corneal curvature (Lin, Tang, Telfair, Machat, Rajian) or thermally shrink the corneal shape (Sand, in Pat. No. 5,484,432) such that patients' vision is corrected And these corrections are ONLY good for myopia and hyperopia and CAN

NOT correct presbyopia. The presbyopia correction proposed in the present patent, on the contrary, does not change the corneal central curvature but only increase the accommodation of the lens by removing portion of the sclera tissue outside the limbus.

(c) Presbyopia correction by a laser is a new procedure which is TOTALLY different from the teaching of prior arts using lasers for corneal "reshaping". Presbyopia correction also requires patient's far view unchanged (or without reshaping of the cornea) and only improve hté near-view by lens accommodation.

(d) Furthermore, the present patent uses a "cold" laser to remove sclera tissue (outside the limbus area) versus a "thermal" lasers in Sand's patent (Pat. No. 5,484,432) to shrink the corneal shape (inside the limbus area). The cold laser of the present has a wavelength range of (0.15-0.36) microns and (2.6-3.2) microns which are also different from that of the "thermal" laser range of (1.80-2.55) microns proposed
by Sand.

(e) The UV laser wavelength at 193nm proposed in the prior arts of Lin etc and the IR wavelength of Lin and Telfair are within the range of (0.15-0.36) and (2.7-3.2) microns proposed in the present patent. However, the teaching of the prior arts are limited to the ablation of corneal central surface. None of the prior art teachings in corneal reshaping can be used for the correction of presbyopia without using the INNOVATIVE teachings proposed in the present patent. In fact, corneal reshaping taught by the prior arts MUST be avoided in the new procedure of presbyopia correction for patients to see near and and far (or keep far view remains as good as prior to the surgery).

(f) The "presbyopia" correction proposed by Ruitz (US Pat. 5,533,997) using an excimer (ArF at 193 nm) laser required the corneal surface to be reshaped to "multifocal" for a presbyopia patient to see near and far. However, Ruitz's "presbyopia" correction is fundamentally different from that of the present patent and should not be called "presbyopia" correction under the definition of lens accommodation per cited in the present patent. The genarlly accepted definition for presbyopia correction is to increase patient's accommodation rather than reshaping the cornea into "multifocal".

In view of the above discussion, the present inventor believes that it would be non-obvious to a normal skill person to utilize the teachings provided by the prior arts of Ruitz,Lin, Machat, Sand etc to achieve the "presbyopia" correction (defined by patient's accommodation) proposed in the present patent. In fact, the concept of laser scleral ablation outside the limbus area (rather than reshaping the central portion of the cornea) is innovative and has been clinically tested based the proposed techniques in the present patent. The present inventor has used these technique to treat over 100 cases of presbyopia patients with very good results and almost no regression after longer than 17 months follow up. These clinical results based on the teaching proposed in the present patent have not been explored by any of the prior arts.

11/27/00

J. T. LIN

(III) Version with marking to show changes made

CLAIMS:

NOTES for changes:

1) Claims 4, 6 were deleted/cancelled/abandoned.

2) Claims 2,3, 5 were included into Claim 1 as part of the independent Claim per suggested by the Examiner.

1. A method of performing refractive surgery by reshaping a portion of corneal tissue, said method comprising the steps of:

selecting a gas laser (adding) generated by transverse electrical discharge in a mixture of neutral gases including at least helium gas and having a pulsed output beam of predetermined mid-IR wavelength of (2.7 - 3.2) microns;

(deleted) and having an energy per pulse less than 15 mJ on the corneal surface;

selecting a beam spot controller mechanism, said spot controller (adding)consisting of an internal magnetic coupler integrated inside the laser cavity having a pin-hole size of about (2-10) mm:

focusing the output beam to a spot size of about (0.05-2.5) mm on the corneal surface.

(deleted)selected laser beam to a predetermined spot size on the corneal surface;

selecting a scanning mechanism for scanning said selected laser output beam;

coupling said laser beam to a scanning device for scanning said laser beam over a predetermined corneal surface area to remove corneal tissue, whereby a patient's vision is corrected by reshaping the cornea.

2. **(moved to Claim 1 as independent claim)** A method of claim 1, in which the said selected laser is a gas laser having an output wavelength of about (2.7-3.2) microns, energy per pulse of about (2-15) mJ on the corneal surface, repetition rate at about (20-500) Hz and a pulse duration of about (10-150) nanoseconds.

3. **(moved to Claim 1 as independent claim)** The method of claim 1, in which the said selected gas laser includes a pulsed radiation generated by transverse electrical discharge in a mixture of neutral gases including at least helium gas.

4. **(deleted)** A method of claim 1, in which the said selected laser is a pulsed carbon dioxide laser which is frequency-doubled to a beam having an output wavelength of about (5.6-6.2) microns, energy per pulse of about (2-15) mJ on the corneal surface, repetition rate at about (20-500) Hz and a pulse duration of about (10-150) nanoseconds.

5. **(moved to Claim 1 as independent claim)** The method of claim 1, in which the said spot controller consists of an internal magnetic coupler integrated inside the laser cavity having a pin-hole size of about (2-10) mm and the output beam is focused to a spot size of about (0.05-2.5) mm on the corneal surface.

6. **(deleted)** The method of claim 1, in which the hydration level of the corneal surface is controlled by a gas blower during the tissue ablation procedure.

(For Claims 7-19, **those with underlines were deleted)**

7. A method for improving presbyopic patient's vision by removing a portion of the sclera ciliary tissue from an eye of a patient, said method comprising the steps of:

selecting an ablative laser beam for removing sclera tissue, said ablative laser which is

focused to a spot size of about (5-500) microns on the corneal surface;

selecting a scanning mechanism for scanning said laser output beam;

coupling said laser beam to a scanning device for scanning said laser beam over a predetermined corneal limbus area to remove said sclera ciliary tissue, whereby a patient's vision is improved by sclera expansion of the cornea.

8. A method of claim 7, in which the said ablative laser is a gas laser having an output wavelength of about (2.7-3.2) microns, energy per pulse of about (0.5-15) mJ on corneal surface and a pulse duration less than 150 nanoseconds;
9. A method of claim 7, in which the said ablative laser is a mid-IR solid-state laser having a wavelength of about (2.7-3.2) microns. and a pulse duration less than 150 nanoseconds.
10. The method of claim 7, in which the said ablative laser includes pulsed radiation generated by transverse electrical discharge carbon dioxide laser which is frequency-doubled into a laser having a wavelength of about (5.6-6.2) microns, energy per pulse of about (2-15) mJ on the corneal surface. and a pulse duration less than 150 nanoseconds;
11. A method of claim 7, in which the said ablative laser is a diode laser having a wavelength of about 980 nm. and having a pulse duration less than 200 microseconds.
12. A method of claim 7, in which the said ablative laser is a diode laser having a wavelength of about (1.4 - 2.1) microns. and a pulse duration less than 200 microseconds.
13. A method of claim 7, in which the said ablative laser is a diode-pumped Er:YAG laser having a wavelength about 2.9 microns and a pulse duration less than 500 microseconds.
14. A method of claim 7, in which the said ablative laser is an ultraviolet laser having a wavelength of about (190-310) nm. and a pulse duration less than 100 nanoseconds.
15. A method of claim 7, in which the said sclera tissue is coagulated by a laser having a wavelength of about (0.5-3.2) microns, an average power of about (0.1-5.0) W on the corneal surface, spot size of about (0.1-1.0) mm, and a pulse duration longer than about 200 microseconds.
16. A method of claim 7, in which the said ablative laser is fiber-coupled and combined with a coagulation laser and delivered to the corneal surface.
17. A method of claim 7, in which the said sclera ciliary tissue is ablated in radial patterns having a length about (2.5-3.5) mm and a depth about (400-700) microns.
18. A method of claim 7, in which the said sclera ciliary tissue is ablated in radial patterns by a computer-controlled scanning mechanism.
19. A method of claim 7, in which the said sclera ciliary tissue is ablated in radial patterns by a translation mechanism.